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CERTIFICATION OF TRANSLATION

I, Bertrand LOISEL, of CABINET PLASSERAUD, 84, rue d'Amsterdam, 75440 PARIS CEDEX 09, FRANCE, do hereby declare that I am well acquainted with the French and English languages, and verify that the document attached is a true and correct literal English language translation of the text of International Patent Application no. PCT/FR98/02489.

Dated this 2nd day of May 2000.

Bertrand LOISEL

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BASE STATION FOR MOBILE RADIOTELEPHONE

BACKGROUND OF THE INVENTION

The present invention relates to a telephone equipment of the cellular radiotelephone base station type for a multilayer network.

The operator of a mobile telephone network distributes the base stations of the network across the territory to be covered, whereby the areas covered by the base stations define the cells. These base stations are linked to other mobile service infrastructures designed to route calls and link up with the wire-line networks.

With the increased density of the cellular networks, the operators more and more often deploy so-called microcellular or multilayer networks, in which base stations of relatively weak power define small sized cells referred to as microcells (the smallest cells are sometimes referred to as picocells; it is considered herein that such picocells are just a particular case of microcells), and base stations of longer range are further provided to form a superimposed layer of umbrella cells, or macrocells. The microcells are used in areas having a strong density of local traffic.

Some of the radio resources are used by the base station in each cell for the broadcasting of beacon signals allowing its detection by the mobile stations located within the cell.

When optimising a cellular radio telephone system, it is essential to limit as much as possible the interference between the different base stations, in order to take the greatest benefit from the frequency re-use principle.

This requirement is somewhat in conflict with the intensive exploitation of the available radio resources. It causes limitations which are most significant when provision of a high communication density is looked for, particularly in the case of microcells of a multilayer network.

An object of the present invention is to increase the radio communication capacity of a microcell, while limiting the interference between base stations in order to optimise the use of the available radio resources.

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SUMMARY OF THE INVENTION

Accordingly, the invention proposes a microcell base station for a multilayer radio communication cellular network, comprising a wire interface for connection to a wire access network and an air interface for communicating by radio with mobile station in accordance with a time division multiple access operating mode, with signal frames each divided into a number N of successive timeslots. Telephone communications involving a mobile station located within radio range of the equipment can be established through the wire network by means of the wire interface and the air interface. The air interface is arranged to transmit a radio signal in each timeslot of the frames on a beacon frequency. This radio signal transmitted on the beacon frequency comprises a beacon signal carrying signalling information, in at least one timeslot as long as at most N-1 of the timeslots of the frame on the beacon frequency are occupied by communications with mobile stations. The air interface stops transmitting the beacon signal when the N timeslots on the beacon frequency are occupied by communications with mobile stations.

The communications involving a mobile station, during which the air interface stops transmitting the beacon signal (it uses the corresponding physical channel for the radio link with that mobile station), or those which require the establishment with said mobile station of a radio link which saturates the radio resources allocated to the equipment. The base station, which can no longer accept any further communication, need not be detected anymore by the mobile stations which will rather communicate through other base stations if necessary. In particular, the base station which stops transmitting its beacon signal may be backed up by that of an umbrella

cell. As soon as radio resources are released, the beacon signal is re-established and the station can resume serving other mobile stations.

The invention enables an increase in the number of communications which can take place at the same time in the microcell. Since that number is not very high (e.g. lower than 10), the additional channel made available by the interruption of the beacon signal is quite interesting.

Other features and advantages of the invention will become clear from the following description of an exemplary embodiment, which is not restrictive in any respect, and with reference to the appended drawings, of

The ~~which the~~ sole figure is a block diagram of an equipment according to the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The figure illustrates a telephone equipment 4 forming a cellular radiotelephone base station, intended to be installed to define a microcell of a multilayer network.

The equipment 4 has a wire interface 5 to be connected to a wire-line telecommunication network 6.

The wire-line telecommunication network 6 is the one which connects the base station to the other entities (BSC, MSC) of the cellular network which supervise the base stations and provide the interface with the switched network. The interface 5 operates in a conventional manner using the protocols of the wire-line network 6.

The equipment 4 also has an air interface 8 connected to the transmitting/receiving antenna 9. The radio range of the equipment is typically of at most a few hundreds of metres.

The equipment 4 illustrated in the figure has a conversion unit 10 between the interfaces 5 and 8. This unit 10 performs the various analogue-to-digital or digital-to-analogue conversions, speech coding/decoding and shaping of the signal frames required to make the interfaces 5 and 8 communicate. A control unit 12

intercepts the signalling messages received on the interfaces 5 and 8 and controls these interfaces 5, 8 and the conversion unit 10 as appropriate.

In the specific example described here by way of illustration, the air interface 8 operates in accordance with the European GSM radiotelephone system used in numerous cellular networks.

In particular, the interface 8 forms a broadcast common channel (BCCH) at a certain beacon transmission frequency. This frequency, on which the station transmits permanently, may be assigned to the equipment by the cellular network operator.

On the BCCH channel, the base station 4 transmits a carrying signalling information. This beacon signal is transmitted with a duty ratio ρ. Since the GSM system is of the time division multiple access (TDMA) type, each TDMA frame being sub-divided into N=8 successive timeslots which may be assigned to different transmissions/receptions, the beacon signal may be transmitted during n timeslots over N ($1 \leq n \leq N$), which gives $\rho = n/N$.

We consider the case of a GSM microcell to which a single frequency is allocated, allowing up to N=8 TDMA channels. The first timeslot (for example) of each frame transports the beacon signal carrying the information relevant to the cell, and the other timeslots are occupied either by communications with mobile stations in the microcell or by stuffing (dummy) bits, so that the base station occupies the beacon frequency as required.

As long as the station supports up to N-1=7 communications with mobile units, the beacon signal is still transmitted other the first timeslot. To establish an eighth communication with a mobile station, the base station allocates the first timeslot on the beacon frequency for the downlink. Therefore, it stops transmitting the beacon signal, and replaces it by the

signal which it produces on the downlink for the communication, thereby saturating the radio resources which are allocated to it. As soon as one of the eight outstanding communications is terminated, the base station has once again an available timeslot which it uses to retransmit the beacon signal. If that timeslot is not the first one, a channel transfer may be useful to release the first timeslot for the retransmission of the beacon signal.

Owing to this process, the communication capacity in the microcell is increased by 14%.

While the beacon signal is not being transmitted, the mobile stations located in the microcells can switch to another cell, in particular to an umbrella cell, and it is not possible for other mobile stations to register with the microcell. As soon as the beacon signal is re-established, those stations can once again be served by the base station of the microcell.